

**COPC:****Copper** CAS 7440-50-8**Test Organisms:** Chicken (Omnivore, Order-Galliformes)**Exposure Medium:** Oral in diet (copper oxide)**Test Endpoint:** NOAEL**Reference:** Mehring, A.L., Jr., et al., 1960, "The Tolerance of Growing Chicken for Dietary Copper". *Poultry Sci.* 39:713-719.**QCE:** 55.3 mg/kg-day

Error! Bookmark not defined. Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Eleven dose levels during critical growth period, growth, mortality- for 10 weeks.
Q <sub>1</sub>	2	2	2	Mortality
Q <sub>2</sub>	1	1	1	Chronic exposure duration
Q <sub>3</sub>	1	1	1	NOAEL
U	2	2	2	
Total AF	4	8	12	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	55.3	55.3	55.3	QCE = quantified critical endpoint
TRV	13.8	6.91	4.61	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	13.8	Test organism is in the same order and trophic level as the functional group members	None
2	6.91	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433, AV442
3	4.61	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**COPC:****Copper CAS 7440-50-8****Test Organisms:** Chicken (Omnivore, Order-Galliformes)**Exposure Medium:** Diet**Test Endpoint:** NOAEL**Reference:** Stevenson, M.H., and N. Jackson, 1981, "An Attempt to Distinguish Between the Direct and Indirect Effects, in the Laying Domestic Fowl, of Added Dietary Sulfate", *British Journal of Nutrition*, 46(1):71-76.**QCE:** 1006 mg/kg-day [1408 mg Cu/day/1.4 kg BW]\*\*

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Rather small group sizes (n=6)
Q <sub>1</sub>	1	1	1	Endpoints are body weight, food intake, egg production, hepatic metals concentrations. Ecologically relevant endpoint
Q <sub>2</sub>	2	2	2	Subchronic duration
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	2	2	2	Subchronic exposure and small group sizes, but detailed characterization of relevant endpoints.
Total AF	12	24	36	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	1006	1006	1006	QCE = quantified critical endpoint
TRV	83.83	41.92	27.89	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	83.83	Test organism is in the same order and trophic level as the functional group members	none
2	41.92	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433, AV442
3	27.89	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

\*Ingestion rate and body weight specified in article

**COPC:** Copper CAS 7440-50-8  
(as copper sulfate)

**Test Organisms:** Mink (Carnivore, Order-Carnivora)

**Exposure Medium:** Diet

**Test Endpoint:** NOAEL

**Reference:** Aulerich, R.J., et al., 1982, *Effects of Supplemental Dietary Copper on Growth, Reproductive Performance and Kit Survival of Standard Dark Mink and the Acute Toxicity of Copper to Mink*, Journal of Animal Science, 55(2):337-43.

**QCE:** 7.87 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Group sizes were small relative to observed variation in responses
Q <sub>1</sub>	1	1	1	Ecologically relevant endpoint
Q <sub>2</sub>	1	1	1	Chronic exposure
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	2	2	2	Parameters observed were relevant but not exhaustive
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	7.87	7.87	7.87	QCE = quantified critical endpoint
TRV	1.31	0.656	0.437	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	1.31	Test organism is in the same order and trophic level as the functional group members	M322
2	0.656	Test organism is in a different order and same trophic level from the functional group members	none
3	0.437	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M422, M422A

**COPC:****Copper CAS 7440-50-8****Test Organisms:**

Rat (F334/N) (Omnivore, Order-Rodentia)

**Exposure Medium:**

Diet

**Test Endpoint:**

NOAEL

**Reference:**Hebert, C.D., et al., 1993, *Subchronic Toxicity of Cupric Sulfate Administered in Drinking Water and Feed to Rats and Mice*, Fundamentals and Applied Toxicology, 21:461-475.**QCE:**

66 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Males appeared to be more sensitive than females
Q <sub>1</sub>	1	1	1	Ecologically relevant endpoint
Q <sub>2</sub>	2	2	2	Subchronic exposure
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	2	2	2	Thorough and well-designed study, but subchronic duration prevented evaluation of long-term effects, e.g., development of tolerance as reported by others.
Total AF	12	24	36	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	66	66	66	QCE = quantified critical endpoint
TRV	5.5	2.8	1.8	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	5.5	Test organism is in the same order and trophic level as the functional group members	none
2	2.8	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	1.8	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

**COPC:****Lead** CAS 7439-92-1**Test Organisms:**

Rat (Omnivore, Order-Rodentia)

**Exposure Medium:**

Oral in diet as lead acetate

**Test Endpoint:**

NOAEL

**Reference:**

Azar, A., H.J. Trochimowicz, M.E. Maxfield, 1973, "Review of Lead Studies in Animals Carried Out at Haskell Laboratory: Two-Year Feeding Study and Response to Hemorrhage Study", In *Environmental Health Aspects of Lead: Proceedings, International Symposium*, D. Barth et al. (ed.) Commission of European Communities, pp 199-210.

**QCE:**

8.0 mg/kg-day (100 mg/kg food)\*(.028 kg/day)/0.35 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	50 male and 50 female rats per dose level. Reproductive three generation (during critical life stage) study.
Q <sub>1</sub>	1	1	1	Mortality, # of tumors, weight gain, # or pregnancies, # of pups born alive, fertility index, gestation index, viability index or lactation index. Ecologically relevant endpoint.
Q <sub>2</sub>	1	1	1	Chronic
Q <sub>3</sub>	1	1	1	NOAEL
U	1	1	1	Pb as lead acetate was fed for a three-generation six-litter study at multiple dosages (0, 10, 50, 100, 1000, 2000 ppm). At 1000 and 2000 ppm dietary Pb, the average weight of weanling rats was slightly decreased. At 10 ppm stippled cells were increased. A decrease in ALAD activity was seen at 50 ppm (however these are not considered adverse effects). 100 ppm Pb is considered the NOAEL.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	8.0	8.0	8.0	QCE = quantified critical endpoint
TRV	8.0	4.0	2.7	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	8.0	Test organism is in the same order and trophic level as the functional group members	None
2	4.0	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	2.7	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

\*ingestion rate and BW taken from data table for animals

**COPC:** Lead CAS 7439-92-1

**Test Organisms:** Beagle Dog (Omnivore, Order-Carnivora)

**Exposure Medium:** Diet as lead acetate

**Test Endpoint:** NOAEL

**Reference:** Azar, A., H.J. Trochimowicz, M.E. Maxfield, 1973, "Review of Lead Studies in Animals Carried Out at Haskell Laboratory: Two-Year Feeding Study and Response to Hemorrhage Study", In *Environmental Health Aspects of Lead: Proceedings, International Symposium*, D. Barth et al. (ed.) Commission of European Communities, pp 199-210.

**QCE:** 13 mg/kg-day (500 mg/kg food)\*(0.24kg/day)/9.41 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Four male and four female beagle dogs were used at each dose level (0, 10, 50, 100 and 500 ppm). Two year study. Average variability.
Q <sub>1</sub>	1	1	1	Food consumption, growth, mortality, blood level and behavior. Ecologically relevant endpoint.
Q <sub>2</sub>	1	1	1	Chronic
Q <sub>3</sub>	1	1	1	NOAEL
U	2	2	2	There was no significant effects on appearance, behavior, weight gain, mortality, or neurologic examination of dogs to 500 ppm. A decrease in ALAD activity was seen at 100 ppm. Further study concluded that while ALAD is essential to the synthesis of hemoglobin, the amt needed is but a small fraction of that normally present and this is not an adverse effect. Lack of reproductive endpoint.
Total AF	4	8	16	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	13	13	13	QCE = quantified critical endpoint
TRV	3.3	1.6	0.81	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	3.3	Test organism is in the same order and trophic level as the functional group members	M422A
2	1.6	Test organism is in a different order and same trophic level from the functional group members	M422
3	0.81	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

\*ingestion rate and BW taken from data table for animals

**COPC:**

Lead CAS 7439-92-1

**Test Organisms:**

Chicken (Omnivore, Order-Galliformes)

**Exposure Medium:**

Diet

**Test Endpoint:**

NOAEL

**Reference:**Eisler, R., 1988, *Lead Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*, Fish and Wildlife Service. Bio. Rep. No. 14. April, 1985.**QCE:**

26 mg/kg-day

500 mg/kg in diet converted to dose by multiplying by 0.105 kg/day ingestion rate and dividing by 2 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source
Q <sub>1</sub>	1	1	1	Endpoint ecologically relevant (growth)
Q <sub>2</sub>	2	2	2	Subchronic study
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	3	3	3	Limited information. Dietary NOAEL appears consistent for a variety of species.
Total AF	18	36	54	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	26	26	26	QCE = quantified critical endpoint
TRV	1.4	0.72	0.48	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	1.4	Test organism is in the same order and trophic level as the functional group members	none
2	0.72	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433, AV442
3	0.48	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**COPC:** Lead CAS 7439-92-1

**Test Organisms:** Bovine (Bos spp., Herbivore, Order-Artiodactyla)

**Exposure Medium:** Diet (in hay and grain)

**Test Endpoint:** LD50

**Reference:** Zmudski, J., et al., 1983, *Lead Poisoning in Cattle: Reassessment of the Minimum Toxic Oral Dose*, Bull. Environ. Contam. 30:435-441.

**QCE:** 2.7 mg/kg-day Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	22 Holstein males (9-12 weeks old) weighting approx. 55 kg. were tested
Q <sub>1</sub>	1	1	1	Lethality
Q <sub>2</sub>	2	2	2	Subchronic study
Q <sub>3</sub>	3	3	3	Lethality endpoint, death w/in 20 d if on milk diet
U	3	3	3	Reasonable design however, pregnant ewes given 3 mg/kg (species sensitivity could be $\geq$ ) daily did not produce adverse effects (DeMayo, et. al., 1982).
Total AF	36	72	108	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	2.7	2.7	2.7	QCE = quantified critical endpoint
TRV	0.075	0.038	0.025	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.075	Test organism is in the same order and trophic level as the functional group members	none
2	0.038	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.025	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A



**COPC:** Lead CAS 7439-92-1

**Test Organisms:** Dog (Omnivore, Order-Carnivora)

**Exposure Medium:** Diet

**Test Endpoint:** FEL Chronic toxic level

**Reference:** DeMayo, A., et al.. 1982, *Toxic Effects of Lead and Lead Compounds on Human Health, Aquatic Life, Wildlife, Plants, and Livestock*, CRC Crit. Rev. Environ. Control 12:257-305.  
Rice, D.C., 1985, *Chronic Low-Lead Exposure from Birth Produces Deficits in Discrimination Reversal in Monkeys*, Toxicol. Appl. Pharmacol. 77:201-210.

**QCE:** 0.32 mg/kg-day Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Tertiary source - cites a textbook
Q <sub>1</sub>	1	1	1	Endpoint not specified
Q <sub>2</sub>	1	1	1	Chronic study
Q <sub>3</sub>	3	3	3	FEL
U	2	2	2	Limited information. However, a chronic study in monkeys reported a similar LOAEL (0.1 mg/kg/day) for CNS effects (Rice, 1985).
Total AF	18	36	54	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	0.32	0.32	0.32	QCE = quantified critical endpoint
TRV	0.018	0.009	0.006	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.018	Test organism is in the same order and trophic level as the functional group members	M422A
2	0.009	Test organism is in a different order and same trophic level from the functional group members	M422
3	0.006	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M322

**COPC:** Lead CAS 7439-92-1

**Test Organisms:** Rat (Omnivore, Order-Rodentia)

**Exposure Medium:** Drinking Water (Pb as lead acetate)

**Test Endpoint:** NOAEL

**Reference:** Kimmel, C.A., et al., 1980, *Chronic Low Level Lead Toxicity in the Rat. I. Maternal Toxicity and Perinatal Effects*, Toxicol. Appl. Pharmacol. 56:28-41.

**QCE:** 0.36 mg/kg-day Specified (5 mg/l in water, rat water intake .025 L/day/0.35 kg BW).

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	#'s of animals in control and Pb groups ranged from 60 to 148 during the pregnancy period (2 generations), from 24 to 75 pre-pregnancy, and 6 to 13 litters during post pregnancy. However, significant variation between replicates was seen, and only females (parental generation) examined.
Q <sub>1</sub>	1	1	1	Food % water consumption, reproductive success, and concentrations in selected tissue. Ecologically relevant endpoints.
Q <sub>2</sub>	1	1	1	Chronic study
Q <sub>3</sub>	1	1	1	NOAEL (although Pb concentrations in blood were increased in females exposed to 5 ppm toxicity was not seen at this level)
U	1	1	1	Good design, studied reproductive effects. Weanling female rats were exposed through mating, gestation and lactation (offspring then chronically). Various dose levels (0, 5, 25, 50 ppm) studied and LOAEL established. Other studies support findings. (DeMayo et al., 1982).
M	0.5	0.5	0.5	Lead acetate placed in drinking water.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	0.36	0.36	0.36	QCE = quantified critical endpoint
TRV	0.36	0.18	0.12	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.36	Test organism is in the same order and trophic level as the functional group members	none
2	0.18	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.12	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

DeMayo, A., et al., 1982, *Toxic Effects of Lead and Lead Compounds on Human Health, Aquatic Life, Wildlife, Plants, and Livestock*, CRC Crit. Rev. Environ. Control 12:257-305

**COPC:****Lead (Trimethyllead) CAS 7439-92-1****Test Organisms:**

European Starling (Insectivore, Order-Passeriformes)

**Exposure Medium:**

Capsule

**Test Endpoint:**

LOAEL

**Reference:**Osborn, D., W.J. Eney, and K.R. Bull, 1983, *The toxicity of trialkyl lead compounds to birds*, Environ. Pollut. 31A:261-275. As cited in Eisler (1987).**QCE:**

2.8 mg/kg-day (0.2 mg/day)/0.070 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	6 groups/ group sex not specified
Q <sub>1</sub>	1	1	1	Endpoint ecologically relevant (behavioral effects)
Q <sub>2</sub>	2	2	2	Subchronic study
Q <sub>3</sub>	2	2	2	LOAEL
U	3	3	3	Limited information: organoform of lead could impact toxicity
Total AF	36	72	108	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	2.8	2.8	2.8	QCE = quantified critical endpoint
TRV	0.08	0.04	0.03	Toxicity Reference Value = QCE/Total AF

  

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.08	Test organism is in the same order and trophic level as the functional group members	AV210A
2	0.04	Test organism is in a different order and same trophic level from the functional group members	AV210, AV221, AV222, AV222A, AV232, AV233, AV241, AV242
3	0.03	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

**COPC:** Manganese CAS 7439-96-5

**Test Organisms:** Japanese Quail

**Exposure Medium:** Oral in diet

**Test Endpoint:** NOAEL

**Reference:** Laskey, J.W. and F.W. Edens, 1985, "Effects of Chronic High-Level Manganese Exposure on Male Behavior in the Japanese Quail (*Coturnix coturnix japonica*)", *Poultry Science* 64: 579-584.

**QCE:** 575 mg Mn/kg BW/day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Only one dose administered, no mention of the number of birds tested
Q <sub>1</sub>	1	1	1	Ecologically relevant endpoint
Q <sub>2</sub>	1	1	1	Chronic
Q <sub>3</sub>	1	1	1	NOAEL
U	3	3	3	Certain amount of food lost by birds eating behavior led to a wide range of food intake, no evidence to suggest altered locomotion as in previous studies
Total AF	9	18	27	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	575	575	575	QCE = quantified critical endpoint
TRV	63.9	31.9	21.3	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	63.9	Test organism is in the same order and trophic level as the functional group members	none
2	81.9	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433, AV442
3	21.3	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**COPC:** Manganese CAS 7439-96-5

**Test Organisms:** Chicken (Omnivore, Order-Galliformes)

**Exposure Medium:** Diet

**Test Endpoint:** NOAEL

**Reference:** Leeson, S., and J.D. Summers, 1982, *Effect of High Dietary Levels of Supplemental Zinc, Manganese, Copper, or Iron on Broiler Performance to Three Weeks of Age and Accumulation of These Minerals in Tissue and Excreta*, Nutrition Reports Int. 591-599.  
Offiong, S.A., and S.M. Abed, 1980, *Fertility, Hatchability and Malformations in Guinea Fowl Embryos as Affected by Dietary Manganese*, British Poultry Sci. 21:371-375.

**QCE:** 1260 mg/kg-day (880 mg/kg food)\*(0.717 kg food/day-bird)\*(1 bird/0.5kg)\*\*

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Adequate number of animals, limited variability
Q <sub>1</sub>	1	1	1	Ecologically relevant endpoint (growth and reproduction)
Q <sub>2</sub>	3	3	3	Acute 13-day study
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	2	2	2	Only poultry production-type endpoints were evaluated
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	1260	1260	1260	QCE = quantified critical endpoint
TRV	210	105	70.0	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	210	Test organism is in the same order and trophic level as the functional group members	none
2	105	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433, AV442
3	70.0	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

\*\* Ingestion rate and BW specified in Table II of the Leeson article.

**COPC:** Manganese CAS 7439-96-5

**Test Organisms:** Rat (Omnivore, Order-Rodentia)

**Exposure Medium:** Diet

**Test Endpoint:** NOAEL

**Reference:** Laskey, J.W., Rehnberg, G. L., and Hein, J.F., 1982, *Effects of Chronic Manganese (MN<sub>3</sub>O<sub>4</sub>) Exposure on Selected Reproductive Parameters in Rats*, J. Toxicol. Environ. Health 9: 677-687.  
ATSDR, Agency for Toxic Substance Disease Registry, 1990, *Draft: Toxicological Profile for Manganese*, 1990.

**QCE:** 88 mg/kg-day 1100mg/kg food\*0.028kg/day/0.35kgBW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Adequate numbers, males, females and juveniles tested.
Q <sub>1</sub>	1	1	1	Ecologically relevant endpoint (decreased testosterone levels, delayed maturation of reproductive function).
Q <sub>2</sub>	1	1	1	Chronic study
Q <sub>3</sub>	1	1	1	NOAEL endpoint
U	1	1	1	Good design, reproductive endpoints examined and the study results consistent in mice.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U = \text{Total AF}$
QCE (mg/kg-day)	88	88	88	QCE = quantified critical endpoint
TRV	88	44	29	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	88	Test organism is in the same order and trophic level as the functional group members	none
2	44	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	29	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322